

(12) **United States Patent**
Yellowhair et al.

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(54) **ALIGNMENT AND FOCUS OF MIRRORED FACETS OF A HELIOSTAT**

(56) **References Cited**

U.S. PATENT DOCUMENTS

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5,861,947	A *	1/1999	Neumann	356/216
5,862,799	A *	1/1999	Yogev et al.	126/578
6,532,953	B1 *	3/2003	Blackmon et al.	126/685
6,597,709	B1	7/2003	Diver, Jr.	
6,899,096	B2	5/2005	Nakamura	
6,984,050	B2	1/2006	Nakamura	
7,207,327	B2	4/2007	Litwin et al.	
2009/0249787	A1	10/2009	Pfahl et al.	
2010/0265602	A1	10/2010	Lata Perez	
2011/0000478	A1	1/2011	Reznik	

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Related U.S. Application Data

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USPC **356/138**; 356/152.2; 126/602; 372/9

(58) **Field of Classification Search**
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See application file for complete search history.

OTHER PUBLICATIONS

Richard L. Wood, "Distant Observer Techniques for Verification of Solar Concentrator Optical Geometry", Solar Energy Research Institute, 1981, UCRL-53220.

M.K. Selcuk, "Parabolic Dish Test Site: History and Operating Experience", Prepared for USDOE through NASA by Jet Propulsion Laboratory, JPL Publication 85-18.

(Continued)

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(57) **ABSTRACT**

Various technologies pertaining to aligning and focusing mirrored facets of a heliostat are described herein. Updating alignment and/or focus of mirrored facets is undertaken through generation of a theoretical image, wherein the theoretical image is indicative of a reflection of the target via the mirrored facets when the mirrored facets are properly aligned. This theoretical image includes reference points that are overlaid on an image of the target as reflected by the mirrored facets of the heliostat. A technician adjusts alignment/focus of a mirrored facet by causing reflected reference markings to become aligned with the reference points in the theoretical image.

20 Claims, 9 Drawing Sheets

